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Abstract

METHODS OF LIFE PERFORMANCE EVALUATION OF PRESSURIZED
OR BOILING WATER REACTORS

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A two-dimensional burn-up study of pressurized and boiling light water reactors has been made, using the diffusion theory approximation.

The main problems dealt with in this paper are:

- calculation of K_{eff} and fast and slow neutron flux distributions throughout the reactor life;
- calculation of two group constants taking into account the spectral variations due to boiling and burn-up;
- study of the effect of control rods on flux distributions and discussion of the optimum strategy of control rod movement;
- coupling between neutronic and thermal-hydrodynamic calculations with particular reference to boiling reactors.

A code (PEARL) has been prepared for the IBM-704 computer. It calculates the neutron flux in two dimensions by using the finite difference method.

Control rod simulation is obtained by an equivalent poison cross-section, homogeneously distributed in the regions where control rods are present. The critical position of control rods is obtained by using a perturbation method.

An attempt has been made to optimize the calculation time through a systematic use of fittings for many parameters: for example, the thermal cross-sections averaged on a Wigner-Wilkins spectrum, and the disadvantage factors for clusters are obtained by means of polynomial expressions.

This method is applied in order to check the general model and the microscopic physical parameters by correlation with data obtained from the operation of existing power reactors and to evaluate the performance of these reactors.

The convenience of applying the Ritz method for flux calculations is discussed. The authors there report some numerical results obtained by applying their methods to the expansion of a boiling reactor flux in harmonics.

The possibility of obtaining the poison absorption cross-section as an eigenvalue has also been studied and is dealt with in this paper.